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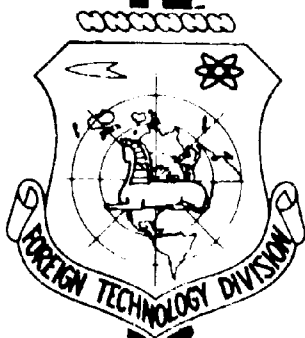
TRANSLATION

POISONOUS BITES

By

M. N. Sultanov

FOREIGN TECHNOLOGY DIVISION



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POISONOUS BITES

BY: M. N. Sultanov

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PREPARED BY:

TRANSLATION DIVISION
FOREIGN TECHNOLOGY DIVISION
WP-APB, OHIO.

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TABLE OF CONTENTS

ANNOTATION	1
INTRODUCTION	1
Poisonous Snakes	3
Certain Biological Characteristics of Snakes	3
Clinical Phenomena After Snakebite	8
The Treatment of Snakebite Victims	20
The Prevention of Snakebite	38
Poisonous Arachnida	40
The Painful Sensations After the Sting of a Scorpion	40
Clinical Phenomena After the Bite of a Karakurt	46
Is the Bite of a Tarantula Dangerous?	49
Hymenoptera	50
Clinical Phenomena After a Sting by Wasps or Bees	50
The Treatment of Stings by Scorpions, Karakurts, Wasps and Bees	55

POISONOUS BITES

Treatment and Prevention

Candidate of Medical Sciences,
M. N. Sultanov

ANNOTATION

This brochure will acquaint a wide circle of readers with the effect of venom from the bite of poisonous snakes and venomous spiders and from the sting of the black scorpion, bees and wasps. Based on his experience the author tells about a method of treating victims, offers measures of protection and especially warns against turning to quacks, who can bring nothing but harm.

INTRODUCTION

For every person, young or old, just the mention of a snake, a karakurt (black wolf) or a black scorpion causes a squeamish feeling that is mixed with fear. The mind recalls numerous tales and legends, frightening stories. And if there is an "experienced," or even just an loquacious storyteller present, there will be no end to the "cases" and examples, stories about snakes and other poisonous animals can run on for hours. But even so, not everyone has the

right idea about these animals, not everyone knows how to correctly administer first aid in case of a bite. Frequently many people even doubt the possibility of successfully treating the victims. Meanwhile, thanks to the achievements of medical science and practice the bites of snakes, black scorpions and karakurts are no longer necessarily fatal to man. Effective means of treating the victims have been found.

Poisonous bites can confine patients to the bed for a long time at the height of the agricultural season and can thereby harm both the health of the victim and the national economy. Nevertheless, until recently the treatment of the bites remained insufficiently studied, as had the peculiarities of the many-sided effect of the venom of snakes, karakurts and black scorpions.

At the present time medical practice is in possession of diverse means and measures of first aid for bites. However, many of these have little effect and are even harmful and only complicate treatment.

Many times we have observed how the victims of snakes bites or stings of insects have suffered because there were no reliable methods of treatment and we set ourselves the task of developing a rational method to relieve them from this suffering. In this we considered it necessary to study the effect on the organism of the separate components contained in a venom for a more precise determination of the index that is the basis for evaluating the effect of the treatment, and also to develop a correct method of first aid.

The purpose of this brochure is to acquaint a wide circle of readers with the new data in this area.

Poisonous Snakes

Certain Biological Characteristics of Snakes

Snakes inhabit many countries of the world, with the exception of the Arctic Zones, New Zealand, the Azores, Crete and Malta. In all there are about 2300 species of snakes, from which about 250 are poisonous.

Poisonous snakes are primarily encountered in the tropics and subtropics. In Europe eight species of poisonous snakes are known, in Africa — about 75, in Asia and on the Malaysian Archipelago — 165, in the Americas, primarily in South America, — 91, in Australia — 80 (D. N. Kashkarov and V. V. Stanchinskiy).

In our country snakes can be found in the Far East, Siberia, the Central Asian Republics, the Caucasian mountains and in the Central Zone. They are most populous in the Azerbaidzhan and Turkmen Republics.

In Azerbaidzhan there are 22 species of snakes, of which 4 are poisonous, all from one family, Viperidae (the common vipers). In Turkmenia there are also 4 species of poisonous snakes, but from different families, cobra, *Ancistrodon halys*, carpet viper and blunt-nosed viper.

As is known, in contrast to the other reptiles, snakes do not have extremities. But certain snakes, e.g., boa constrictors, and in Azerbaidzhan the sand snakes, have small claw-like rudiments (under-developed remains) of hind legs.

The body of a snake is covered with horny scales. The head of a snake is covered with thicker plates. Blunt-nosed vipers have small, randomly distributed, plates on their head.

The presence of a large number of vertebrae (from 200 to 450)

allows snakes to flex, extend and coil; this makes their bodies very mobile. Thanks to this mobility, a snake can crawl. The ends of the ribs serve as support.

The most complicated part of the skeleton of a snake is the skull. The mobile connection of the jaw and the bones connected to it enables a snake to open its mouth very wide and swallow a huge object, one that significantly exceeds the dimensions of its throat.

The most highly developed of their sensory organs is the organ of touch, the tongue, which is divided into two fine parts and distinguished by high mobility. Their vision is rather good, but they lack the sense of hearing. Their sense of smell is weakly developed. The only sound they can produce is a hiss upon excitation.

Snakes lack skin glands, due to which evaporation from the surface of their bodies is strongly decreased. It is also characteristic that snakes do not secrete urine, but uric acid. This is connected with their small intake of water: snakes are satisfied by the water they consume in the form of food.

Snakes are cold blooded. The temperature of their body is regulated by the surrounding medium. Therefore, the activity of snakes directly depends upon the temperature of the surrounding medium: the higher the temperature of the air, the more active snakes are. As academician Ye. N. Pavlovskiy has noted, beyond the Arctic Circle, where the day is six months long and night also, adders are active for three months and hibernate the remainder of the year, while in the Azerbaïdzhan Republic they are active for about six months.

The active habits of snakes, as those of all other poisonous animals, begin with the onset of dusk. At this time their pupils

dilate widely. The duration of the active period depends upon the species of snakes. Thus, e.g., while the blunt-nosed viper hunts in the evening and the early morning, Radde's viper and the *Ancistrodon halys* are active in the first half of the night, the common adder and Renard's viper hunt the whole night, especially when it is warm, etc. It is characteristic for snakes and other poisonous animals that during the night they will crawl towards light sources (campfires, lamps, etc.). This fact is frequently used for catching and exterminating poisonous animals.

According to their method of reproduction snakes are divided into viviparous, oviparous and ovoviviparous. Thus, e.g., the common vipers are ovoviviparous, i.e., the embryos develop in the body of the mother, their embryonic development takes about two and a half months. The young break out of the shell just when the eggs are laid, and sometime even in the body of the mother. The quantity of eggs varies from 8 to 18. The number of young born varies from 5 to 13 (Fig. 1).

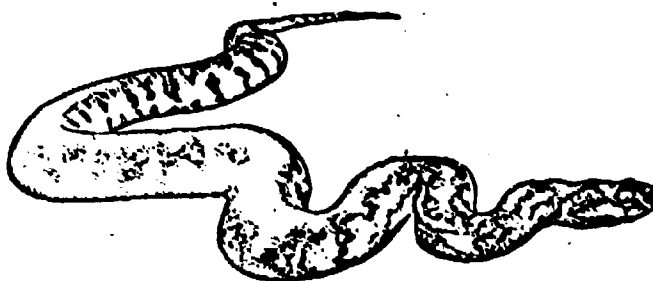


Fig. 1. The blunt-nosed viper

The blunt-nosed vipers are born with fangs and venom glands. After "birth" they immediately begin independent life. The weaker embryos of blunt-nosed vipers cannot break through the egg shell, and the mother eats these eggs after the "birth" act is over.

The reproductive season of snakes depends upon the climatic conditions of the given location. Thus, in the Nakhichevan Republic snakes begin to reproduce at the end of June and continue through July and August, but in Armenia snakes reproduce basically in August.

The coloring of snakes is diverse (this is especially noticeable in adders) and depends upon their habitat. Sandy and grayish colors are characteristic for snakes in desert areas. In tropical forests snakes are usually bright green.

Like many other animals, reptiles hibernate in cold seasons. Sometimes they even hibernate in the warmer seasons of the year: in Turkmenia, e.g., in July and August there have been cases of snakes hibernating and this hibernation continues until the onset of more favorable weather.

In the winter snakes use the burrows of rodents and hibernate at a depth of 70 - 90 centimeters, where even during very cold weather the temperature does not fall below 9 degrees above zero. Hibernating snakes do not like extreme dryness nor extreme moisture. They usually spend the winter in a group of several. They are sustained through hibernation by the accumulation of fat that they have formed in their stomachs during the active season.

The awakening of snakes from hibernation is directly connected with the climatic conditions of each locality. Thus, e.g., M. P. Raspopov has observed the awakening of snakes along one railroad at different times.

For a long time after awakening in the early spring snakes are not very active and do not crawl about, but warm themselves in the sun close to their burrows. However, even at this time a snake can bite a person if he accidentally steps on it.

There is no doubt that a more precise determination of the time of winter hibernation, especially for poisonous snakes, has a definite value for the prevention of snakebites.

On the basis of the archive material we have studied and our observations over more than 15 years, and also based on numerous conversations with people who have been bitten by snakes, we have not been able to establish that common vipers are aggressive, i.e., that they have attack a man without cause. There is an Azerbaidzhan proverb that says: "if you don't step on a snake's tail, he won't bite you." In our opinion this is true.

According to our observations, most snakebites (1.8%) occurred during the day, when poisonous snakes are less active and are usually near their burrows, warming themselves in the sun; only 18.2% of snakebites occurred at night, when poisonous snakes are really active.

The causes of these snakebites were diverse: they were stepped on or gathered up into a bundle together with branches or bushes. In other cases the snakes bit when they were disturbed, for example, when one was wounded by a scythe during the harvest, etc.

Thus, we can consider it established that common vipers are not aggressive. Man himself is always the guilty one. In all cases the bite occurs absolutely accidentally and unexpectedly, without any conscious action of the victim. These snakes bite while protecting themselves.

As for aggressiveness in other species of snakes, only the carpet vipers attack man, and these attacks are extremely rare.

Clinical Phenomena After Snakebite

The poisonous fangs in snakes are located on the front surface of the mouth cavity and are surrounded by gums. These fangs are mobile and when the mouth is closed they lie longitudinally along side the tongue; when a snake opens its mouth they raise up and become perpendicular to the jaw. They are sharp and at the same time brittle. Like needles, they can penetrate soft coverings, but when they meet a hard object they slide and are easily broken. Broken fangs are very rapidly replaced by new ones, which are located in the submucous along side the poisonous fangs. The length of an adder's fangs attain 1 centimeter.

The opening to the venom canal is in different places on the fangs of different snakes. Thus, in the common vipers it is located on the forward side of the fang, and the base of the canal opens onto the duct of the venom gland.

The venom glands in snakes are located on both sides of the skull, in back of the eyes. They are surrounded by the temporal muscles. Each gland is connected to the base of the venom canal in the fangs by special excretory canals (Fig. 2). After a snake has thrust its fangs into something, it tries to extract them. Between the bitten region and the fangs an empty space is formed that is fully sufficient to drain off the venom. At the moment of the bite an involuntary contraction of the temporal muscles expels the venom from the glands. It flows to the place of the bite and, rapidly spreading in the organism of the victim, causes the toxic effect.

There is a folk tale that goes: "if a snake does not turn over onto its back as it bites you, it will not excrete any venom." But

this is false; as was stated above, the venom is expelled by a reflex contraction of the temporal muscles.

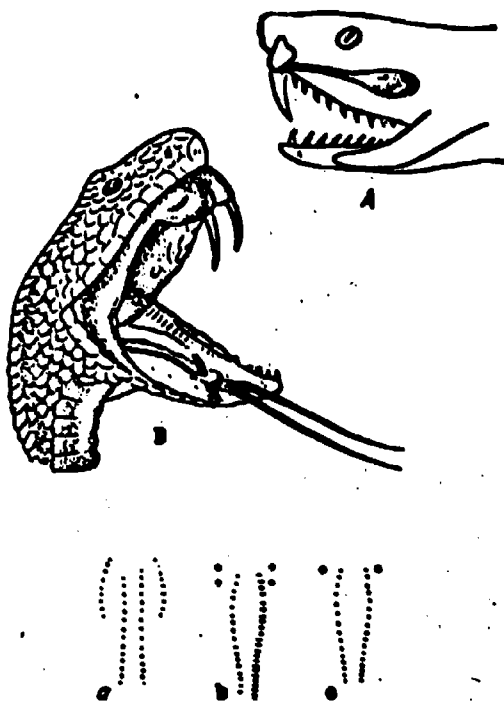


Fig. 2. (A) venom apparatus of a snake (schematic). The venom gland, opening into the base of the fang, is visible. (B) the open mouth of a blunt-nosed viper. Two fangs, the extended tongue and the opening to the throat are visible. (C) the traces of snakebite on human skin: a) nonpoisonous snake; b and c) poisonous snakes.

The amount of venom in the glands depends upon the time of the year and the species of snake.

The common adder has 30 mg of venom, the long-nosed viper and the cobra have up to 220 mg, rattlers have 300 - 370 mg, etc.

The quantity of venom excreted by different snakes when they bite varies in each separate case.

Thus, rattlers secrete the most, 4 - 6 drops of venom, cobras -- from 0.04 to 0.19 grams (Fig. 3), on the average 0.08, adders - 0.005 to 0.03, on the average 0.01, and vipers - 0.01 to 0.03, on the average 0.06 [sic], etc.

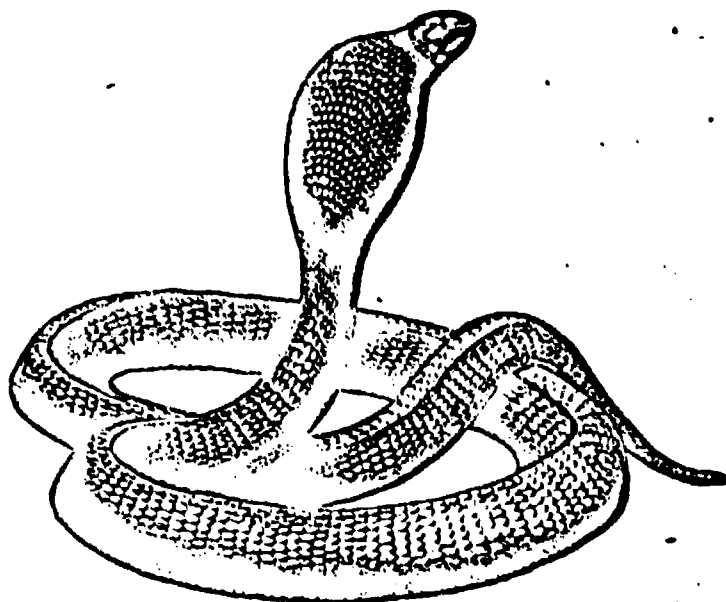


Fig. 3. Cobra.

Consequently, the degree of poisoning of the organism depends not only upon the species of snake, but also upon many other factors, which will be discussed below.

Snake venom is a watery liquid that is transparent or straw-yellow or a greenish color. It has an acid reaction. In contrast to other venoms, cobra venom has a neutral reaction. The venom of adders is bitter to the taste and foams. Venom is odorless. In water it settles to the bottom, but when mixed with water it forms a light suspension.

Snake venom dries very slowly, being concentrated into crystals. The quantity of dried venom composes 15 to 26.3% of its weight in liquid form.

As M. I. Yelisuyskiy has noted, 60 mg of liquid venom can be extracted from the glands of adders, and from this quantity 15 – 17 mg of dried venom can be obtained. In the dried form it retains its poisonous properties for a long time. S. I. Ognev has shown that

dried venom does not lose these properties for 16 - 22 years, and according to F. F. Talyzin, if dried venom is stored in a dark hermetically sealed vessel it remains poisonous for 26 years. However, solutions of venom lose their effectiveness after several days.

It has been established that the venom of blunt-nosed vipers deteriorates upon heating to 70 degrees and at 90 - 95 degrees it fully loses its effectiveness.

If swallowed, venom causes inflammation of the mucus membrane of the gastrointestinal tract. If the mucus membrane of the mouth and digestive tract are whole, then, as through healthy skin, snake venom is not absorbed.

The chemical composition of snake venom is very complex. Fon-Klobuzitskiy has established about 16 different types of substances, each of which has a selective effect on one or another organ. For example, neurotoxins affect the nervous system, endotheliolysins affect the inner membrane of blood vessels, hemolysins affect red blood globules, cardiac toxins affect the cardiovascular system, etc. In the opinion of scientists, it is possible that snake venom contains still other components, as yet unfound.

In spite of the complexity of the chemical composition of snake venom, its physical properties are distinguished by great stability. It has significant toxicity.

The severity of poisoning of an organism by venom and the degree of development of the basic symptoms of snakebite depend upon many causes and circumstances, primarily upon the temperature of the surrounding medium: the poisonous effect of snake venom increases with heat. As academician Ye. N. Pavlovskiy has noted, in tropical countries the effect of snake venom is much greater than it is in

countries with a temperant climate. In Brazil there is a case of the foot of a snake bite victim becoming gangrenous and falling off, and another case when the victim was bitten on the elbow and his fingers fell off.

On the basis of observations of more than 200 snakebite victims, we have become convinced of the serious value of the heat factor. It is sufficient to introduce the fact that the predominant number of serious snakebite incidents in the Nakhichevan Republic are observed from June to September, in the warmest months.

Certain investigators justly attach serious importance to the area of the bite. Thus, e.g., a bite on the face or head is very dangerous. This creates favorable conditions for the rapid absorption of the venom into the central nervous system with subsequent disruption of the activity of many vitally important centers.

The most dangerous case is a snakebite in a blood vessel, although this is very rarely observed. Usually such a bite causes death. Certain authors explain the rapid onset of death by the fact that under the effect of snake venom the blood immediately coagulates; this occurs particularly rapidly inside the heart.

Together with seasonal peculiarities and other causes the condition and size of the snake, whether it was hungry, the depth of penetration of the fangs through the clothing, the dryness or wetness of the skin, the general condition of the victim, whether the snake had bitten anyone before this, etc., are also important.

Certain authors assert that adders are most poisonous when they are shedding. The venom in the glands of hungry snakes is usually more concentrated and dangerous, and the amount of venom in the glands of a snake that has recently eaten is not great and

it is less dangerous. We must remember that in the summer the usual quantity of venom is accumulated in the glands of snakes over 15 days, but in the winter this accumulation takes about a month.

How does the effect of snake venom appear?

In the area of the bite we usually observe two parallel red dots, the points where the fangs penetrate, which soon become partly noticeable due to the swelling.

In spite of the diversity of the clinical phenomena that develop after snakebite they can be subdivided into two groups.

Phenomena of a local character belong to the first group, and phenomena of a general character belong to the second.

The degree of expression of the clinical phenomena depends upon the predominance of one or another substance contained in the composition of the snake venom. In spite of the existence of more than 250 species of poisonous snakes whose venom contains different substances, the basic difference in the effect of a venom is caused by the predominance of two substances in its composition, neurotoxin and hemolysin. For example, hemolysin predominates in the venom of adders, and the venom of cobras contains more neurotoxin.

Neurotoxin affects the nervous system and causes a dysfunction of the central nervous system. And under the effect of hemolysin there is a decrease in the red blood globules, the erythrocytes.

Snake venom also contains other substances. As we have already said, they also have a selective effect on one or another organ.

A viper bite causes swelling. The place of the bite is painful, sometimes liquid-filled blisters form.

Swelling begins 15 - 25 minutes after the bite and increases for 1 - 4 - 7 days depending upon the severity of the poisoning.

This swelling sometimes covers the whole bitten area, and in separate cases it extends even further. Together with sharp swelling we sometimes observe hemorrhages, especially around the area of the bite.

The cause of swelling and hemorrhage is the destruction of the inner membrane of the blood vessels under the effect of endothelolysin. In this we observe the exit beyond the limits of the vessel not only of the liquid part of the blood, but also of the formed elements, particularly the red blood globules. In contrast to other types of swelling, in this case the swelling has a bloody or the so-called hemorrhagic character.

Another local phenomenon is the formation of blisters that are filled with liquid (Fig. 4). These blisters usually develop in the area of the bite, but in separate cases they can develop far from it. At first they are small, no bigger than a pea. As the swelling develops the dimensions of the blisters also increase, and then, growing into each other, they cover a large section.

At first the blisters are filled with a transparent liquid, then it becomes bloody. It is dangerous that usually under a blister there is a section of gangrenous tissue, which is not subjected to treatment for a long time (Fig. 5).

The basic cause of blisters and gangrenous tissue is the application of a tourniquet above the place of the bite. One of the causes of great swelling and skin hemorrhages is also the application of a tourniquet, the harmfulness of which will be discussed below.

Another type of local effect of snake venom is pain and loss of skin sensitivity in the area of the bite, frequently in the whole bitten limb.



Fig. 4. Blisters that develop in the region of a bite.



Fig. 5. A section of gangrenous tissue under a blister.

The pain at the moment of the bite is no greater than that of a pin-prick.

After several minutes together with the onset of hemorrhagic swelling the pain increase intensively, taking on the character of a burn at the place of the bite.

According to our observations, a decrease in the intensity of the pain is noticed $1\frac{1}{2}$ - 2 to 5 - 7 hours after the initial treatment with snakebite serum.

Then pain is felt in the swollen extremity during motion. The full disappearance of pain is connected with a decrease in hemorrhagic swelling.

Together with a painful sensation a decrease, and sometimes even a full absence of sensitivity of the skin is noted in the area of the bite.

The degree of the loss of sensitivity, just as the intensity of the painful sensation, depends upon the severity of the snake venom poisoning. While in a victim with a mild degree of poisoning the loss in sensitivity of the skin is weakly or not at all expressed, for an average or a severe snakebite the loss in sensitivity is sharply expressed. Sometimes skin sensitivity is completely lost.

The restoration of sensitivity over 1 - 4 - 17 days also depends upon the degree of poisoning. For victims who had cuts made and tight tourniquets applied skin sensitivity is restored at the moment the wound heals.

Snakebite victims exhibit an increase in the lymphatic nodes (lymphadenitis) in the bitten extremity. All this develops gradually: towards the end of the second day the lymphatic nodes join into one unit and form a single conglomerate in the form of a lump.

The increase in the lymphatic nodes also depends upon the degree of poisoning of the organism by snake venom. They return to normal significantly earlier than the swelling.

After a snakebite especially if cuts are made, thrombophlebitis — a clogging of the blood vessels by coagulated blood — is also observed.

The clinical phenomenon of the general effect of snake venom is basically caused by the effect of neurotoxin and is characterized by the development of difficult breathing, heart throbbing, quickening of the pulse, dizziness, nausea, occasionally vomiting, a dry and bitter taste in the mouth, a rise in body temperature, etc. These phenomenon develop in 15 - 25 minutes to 1 hour after the bite depending upon the degree of poisoning of the organism by snake venom.

In victims bitten by vipers all these phenomena pass 1 - 2½ - 3 hours after the start of treatment.

The respiratory center is the most sensitive to snake venom. The degree of paralysis of respiratory motion is proportional to the quantity of venom that gets into the organism as a result of the bite. At small doses of venom respiration begins to quicken, and then is paralyzed. Under the effect of large doses paralysis of the respiratory center occurs rapidly. Therefore, artificial respiration is no help when breathing stops after a snakebite. Regardless of the cessation of breathing and the sharp drop in blood pressure, the heart continues to beat from 5 to 12 - 15 minutes. This circumstance gives a serious basis for the application of energetic treatment when respiration stops after a snake bite.

As our observations of three victims who had fallen into an unconscious state show, through slow intravenous injection of snake bite serum and other substances that tone the activity of the cardiovascular system we managed to save their lives. About 15 - 25 minutes after the start of treatment, simultaneous with restoration of the blood pressure, the respiratory motions were restored.

Together with the effect of neurotoxin and the so-called cardiac toxin, other factors, especially fear, are the causes of accelerated heart beating.

Even a single mention of a snake bite or an accidental encounter with a snake, frequently even a nonpoisonous snake, frightens man. Over the centuries from generation to generation a great multitude of frightening legends and stories have been told and retold about these quiet and dangerous creatures.

These tales worsen the condition of a snake bite victim, and

therefore, the disorder of the nervous system of the patient to one or another degree negatively affects the clinical flow of the illness. There is no doubt that the reaction of people who suffer from neurasthenia or hysteria differs from the reaction of people who do not suffer from these neural disorders.

Therefore it is necessary to have a psychological effect on the patient; we just explain the possibility of full recovery from the results of snakebite.

In snakebite victims there is a decrease in the number of red blood corpuscles, which begins from the first hours after the bite. In this a significant decrease in the quantity of red blood globules, erythrocytes, is observed. Their restoration occurs very rapidly after the start of treatment with snake bite serum.

The white blood globules, leukocytes, also undergo characteristic changes; in the human organism these globules fulfill the role of phagocytes: they absorb the microbes that get into the organism from outside.

Immediately after the bite a sharp increase in the quantity of the leukocytes is observed, and after the injection of snake serum this quantity returns to normal. These data testify that the increase in the quantity of leukocytes means an intensification of the struggle of the organism with the snake venom and it is a response of the blood-producing organs, especially those that produce leukocytes, to the stimulating effect of the venom.

Under the effect of viper venom a sharp acceleration of blood coagulation is observed.

The complexity of the composition of snake venoms gave contemporary medicine the possibility to apply small doses of them to treat different diseases.

In the Soviet and foreign literature several reports of both theoretical and practical interest have been devoted to this question.

It has been established that, in minimal doses, cobra venom, acting on the nervous system, produces a pain-relieving effect.

Small doses of cobra are applied as a pain reliever and sometimes as a remedy for malignant tumors.

A tincture prepared from snake heads has a strong diuretic effect. An extract prepared from snake skins possesses antineoplastic properties, in other words, it prevents the development of malignant tumors.

Small doses of snake venom are also applied to treat different diseases: epilepsy, St. Vitus' dance, myalgia, lumbago, bronchial asthma, gynecological hemorrhage, etc.

Levin and Vel'f have treated epilepsy with rattler venom, and Kal'mett and Makht, with cobra venom. Resk and Gol'dberg have successfully applied snake venom for gynecological hemorrhages.

Small doses of the venom of blunt-nosed vipers have favorable antihemorrhagic properties during operations on the ear, throat and nose. After application of a swab that has been dipped in this venom in a 1: 10,000 dilution, for 93.5% of the patients bleeding stopped in 20 -- 30 seconds. This method, developed by Yu. B. Iskhaki, also produces a significant shortening of the duration of painful sensations in the throat.

Thus, we can see that snake venom conceals in itself powerful remedies and, perhaps, it will be the source of substances that will rid humanity of many diseases.

In the literature there are references that even in ancient Egypt and ancient Rome they prepared powers and tinctures from dried snake heads for treating different diseases. Even in ancient times

a snake, as the symbol of wisdom and doctoring, was represented in the emblem of medicine.

The Treatment of Snakebite Victims

Throughout the whole history of humanity at first folk medicine and then medical science have sought effective means and methods of treating snakebite victims.

The search for more effective means and methods of treating snakebite victims was particularly widely established in those countries where snakebites were a real distress to the people. Thus, in 1886 Freyzer calculated that there were 11,416 snake bite victims in India. O. Tashenverg wrote about 173,511 cases of snakebite in India during 9 years. As M. G. Shraybor and T. A. Malyugina have noted, in Brazil in 1914 from 19,200 snakebite victims 4,800 died.

According to the data of a number of authors from various regions of the Soviet Union, the number of agricultural workers bitten by poisonous snakes demands attention even in our time. Thus, for example, I. M. Akhmedov at the AGDASH Regional Hospital (Azerbaijan Republic) observed 202 snakebite cases during 1931 - 1954. From 1934 to 1944 in Turkmenia G. I. Ishunin established 161 cases. From 1946 to 1960 we observed 233 snakebite victims at the Nakhichevansk City Hospital. Snakes often bite agricultural workers. According to the data of N. A. Farzaliyev from the Kazakhsk Interregional Veterinary and Bacteriological Laboratory (Azerbaijan Republic), 274 cases of agricultural workers being bitten by snakes were observed.

From the statistical data we can establish that just in the course of 2 years (1957 - 1958) 980 head of short- and long-horned cattle died from snakebite in Nakhichevansk Republic.

The cause of death or very prolonged treatment of snake bite

victims is that even until now, neither in medical nor in veterinary practice has a rational and single method of treating them been developed. Even now various nonspecific and symptomatic means and measures of first aid are being applied that do not guarantee prompt detoxication of the venom in the organism of the victim.

Below we will consider nonspecific substances that have found wide application in the treatment of snakebites.

Starting from 1947, especially in the last decade, a solution of Novocaine has become the most widespread in medical practice. It is introduced subcutaneous, intramuscularly and also intravenously.

However, a study of the archive material and also our experience with the application of a Novocaine solution do not support the expected favorable effect. Of course, in this we cannot disregard a certain improvement in the state of well being of the patients. This is basically connected with a decrease in the pain sensations that arise in the area of the bite. However, Novocaine cannot detoxicate the separate fractions of snake venom. Consequently, the decrease in pain sensations and the improvement in the general state of well being of the patient, as it were, give false hope to the doctor and the patient. The observations of Ferraton, Faur and others have established that different nonspecific substances (solutions of potassium permanganate, sodium thiosulfate, calcium chloride and others) can produce their effect, to any recognizable degree, only in the first minutes after the bite. Unfortunately, snakebite victims usually get to a hospital no earlier than 1 - 2 hours after the bite, when the venom is already fully spread over the whole organism. Furthermore, it has been established that certain remedies applied to the skin surface do not come into contact with the venom, and when they are

injected into tissue, by destroying it, they lower the resistance of the tissue to infection.

Consequently, the application of a Novocaine solution or other nonspecific substances is evidently based on the improvement of the general well being of the patient and does not take into account the total effect of snake venom on separate organs and on the organism as a whole with its serious consequences. Therefore, nonspecific substances should not be applied for treatment of snakebite.

Some doctors have applied transfusions of banked blood and others are proponents of blood transfusions from people who have survived snakebite. This assumes the presence in their blood of specific immune bodies that can detoxicate snake venom. However, even with this the necessary effect was not attained.

In certain countries of the world, where a large number of fatal snakebite cases occur, it has been proposed to develop antiserum for vaccinating people similar to those developed for vaccination against smallpox, cholera, black death and other diseases.

It has been established that the immunity developed against snake venom does not last longer than 20 - 30 days. Consequently, the production of an immunity against snake venom has not yet been accomplished and a snakebite serum, which can detoxicate snake venom in the organism of the victim, has not found widespread application as a preventative measure.

Certain authors suggest giving alcohol to a snakebite victim. In their opinion alcohol is the most effective substance against venom and it calms the nervous system. But there is no foundation for this point of view. Better founded investigations have established that when alcohol is taken the snake venom is fixed in the nervous

system, and this has a negative effect on any future remedies taken.

Considering the harmful effect of alcohol even on a healthy organism, we cannot speak about any useful effect of it in the case of poisoning by snake venom.

As was stated above, even in ancient times man has sought means to struggle against the tragic effects of snakebite.

In applying different first aid measures medicine men proceeded from concepts that essentially have no scientific or practical foundation except that of comforting and giving the victim a psychological boost against the age-old fear of snakebite.

In spite of this, even now in practical medicine some ancient, firmly implanted measures of first aid are applied. These include: the application of a tourniquet above the point of the bite, making incisions and burning the area of the bite, trying to suck out the venom, etc.

There is no need to prove the uselessness of sucking out snake venom by mouth from a puncture that was made by, as it were, the thinnest possible needle, the more so because after the bite this area quickly and fully closes due to the elasticity of the skin.

In folk medicine the application of a tourniquet above the place of the bite is considered one of the basic first aid measures. In medical practice there are two contradictory opinions about this question. First of all it should be noted that a tight tourniquet disrupts arterial blood circulation and a loose tourniquet disrupts venous blood circulation and lymph circulation. Considering the rapidity with which snake venom spreads, the application of a tourniquet not only can not prevent its spreading, but, by disrupting lymph-blood circulation, it usually leads to the development of great

swelling with a sharp deceleration (more than 2 - 3 times) of its reverse absorption, and also to various serious consequences such as the development of blisters, under which there are usually sections of gangrenous tissue. Therefore, the application of a tourniquet above the place of the bite is not only senseless, but also harmful.

For an example let us introduce this case.

Patient I. A. K was 23 years old. After he was bitten on the nail bone of the little finger of his right hand a tight tourniquet was immediately applied at the base of the finger. Soon his condition began to worsen. He was first brought to the village, and then in an automobile to the Nakhichevansk Hospital.

When he was admitted to the hospital his condition was extremely serious. His mind was not clear, his breathing was superficial. The swelling, ever increasing, now covered his whole right hand. On the back surface of his little finger there was a wide hemorrhagic blister and the skin was a bluish color. After the tourniquet was removed 55 mg of the snakebite serum "antiviper" was slowly injected intravenously, and after 15 minutes 35 mg of serum was administered subcutaneously in the interdigital region. Then a solution of adrenaline and caffeine was injected.

After 15 - 20 minutes the condition of the patient began to gradually improve, his mind became clear. Three hours after the start of treatment the condition of the patient was already satisfactory. But, all the same, his whole arm was swollen.

The hemorrhagic blisters were cut open and sections of gangrenous tissue were found beneath them.

On the 11th day after the bite I. A. K was released from the hospital. His condition was good; however, a wound in the region of

gangrenous tissue had not yet healed)(Fig. 6). Because the tissue was fully gangrenous one joint of the bitten finger was later amputated.

From this example it is clear that the application of a tight tourniquet immediately after the bite in no way prevented the spreading of snake venom in the organism. Even a severe poisoning of the organism later developed.

In another case after a boy was bitten his comrades applied a tight tourniquet (Fig. 7); however, the patient M. F., who was 12 years old, was brought to the hospital with severe poisoning of the organism and a wide section of gangrenous tissue between the tourniquets.



Fig. 6. Patient I. A. K the day we was released from the hospital.



Fig. 7. Patient M. F. the day we was admitted to the hospital.

The application of snakebite serum, which quickly detoxicated the snake venom, brought on an improvement of the general state of the patient. On the 10th day he was released from the hospital for out-patient treatment.

The wide wound did not respond to treatment for 3 months. After it healed there were deep scars, which bothered the patient when he walked and also in damp weather.

Similar cases have been reported by numerous authors. A. S. Inamaliyev notes that two snakebite victims developed draining gangrenes below the tourniquet. In spite of treatment with snakebite serum, one of these died, and the second had to have a amputation.

According to the report of N. Z. Monakov, of 64 victims 11 had to have their lower legs, which were gangrenous due to the application of a tourniquet, amputated.

According to our data, snakebite victims to whom tourniquets were applied remained under treatment $2\frac{1}{2}$ times longer than those who arrived at the hospital without tourniquets. Many of the victims with tourniquets had to be released into outpatient treatment because they developed wounds which would not heal for a long time.

Besides the noted results, as was stated above, the application of a tourniquet promotes the development of swelling.

Wide explanatory work helped us to attain a sharp decrease in the number of cases when tourniquets, which bring only harm, were applied. In 1953 - 1955 71.4% of all snakebite victims brought to the hospital had had tourniquets applied, and in 1959 - 1960 similar cases were almost not observed. With this the stay in the hospital were shortened more than $3\frac{1}{2}$ times.

The application of incisions on the place of the bite has also become a practice. These incisions are usually made with whatever is handy: a piece of glass, a dull knife, a razor, etc. Even some surgeons are proponents of long and deep incisions in the area of the bite. Some even proposed applying suction cups to the area of the

incisions.

The purpose of incisions is supposedly to prevent the snake venom from getting into the area of the organism that lies above the bite. It is assumed that a significant amount of the venom will flow out with the blood. In connection with this we should remember the words of academician Ye. N. Pavlovskiy about the character and peculiarities of the propagation of snake venom, which "is one of the most frightening in the speed and force of its action."

It is sufficient to introduce a case that is, in our opinion, one of the most exemplary.

During work in the mountains O. N. A, who was 35 years old, was bitten by a snake on the lower third of his right shin. His comrades put two tight tourniquets on his shin. The patient had to walk to the hospital. After walking about one kilometer, he lost consciousness and fell. His comrades carried him to a highway and hitched a ride to the hospital.

At the hospital the tourniquets, which were cutting into the swelling flesh of the shin, were removed with great difficulty. A surgeon made four long and deep incisions on the foot and shin; then a novocaine solution (about 30 mg) was injected. By this time blisters had formed on the back surface of the foot; at first small, then growing together, they covered a wide section. On the third day the swelling had reached the right chest. Strong hemorrhaging was noticeable over the whole surface of the swelling.

On the 4th day, according to the wishes of the patient and his relatives, in very serious condition he was transferred from this hospital to the surgical section of the Nakhichevansk United Republic Hospital named after Narimanov.

After a subcutaneous injection of 50 mg of snakebite serum, and also adrenalin with caffeine, his general condition gradually improved. The blisters on his foot were out; there were wide sections of gangrenous tissue under them. The cut wounds secreted a bloody pus,

In the subsequent days, in spite of the sharp improvement of his general condition, the swelling on the shin with the wounds that did not respond to treatment remained. All forms of treatment were applied; however, there was no improvement.

On the 63rd day O. N. A was released to outpatient treatment and only after 5 months did he gradually begin to walk on crutches. His ability to work was completely lost (Fig. 8).



Fig. 8. Patient O. N. A on the 113th day after the bite.

Such a sad and inexcusable outcome in our progressive century! The application of tourniquets and incisions can complicate recovery and even make an invalid of a snakebite victim.

It is possible to assume that the outcome in this case was so

deplorable due to the severity of poisoning of the organism by snake venom. However, proceeding from numerous observations, we have a basis to contend that patients admitted with a significantly more serious degree of poisoning, sometimes even in a hopeless condition, but without the application of tourniquets or incisions, showed a sharp improvement in their general state after snakebite serum was administered and they were soon healthy enough to be released.

Of 187 snakebite victims that were treated with serum we have not observed any complications.

Thus, on the basis of the above introduced data about the saving of numerous lives, we must get rid of these harmful procedures as soon as possible. We must explain the harm of incisions and tourniquets to the widest layers of society and primarily to agricultural workers.

In some cases even in medical practice, to detoxicate the snake venom, the area of the bite is sometimes burned with a glowing hot object or with concentrated acids. This procedure is as harmful and unnecessary as are incisions and tourniquets. We do not feel that it is necessary to consider this in detail. It is sufficient to remember the speed with which snake venom spreads in an organism.

Finally, the interference of quacks is absolutely undesirable and even dangerous for the life of the victim. One of the reasons people turn to quacks can be considered the absence in medical practice of reliable means of treating certain diseases. This also pertains to the treatment of patients who have been bitten by poisonous snakes.

In the Caucasian mountains there was a well-known quack, Dzhavair Sarkisyan, from the village of Davalu (formerly Ararat) of the Armenian Republic. It must be said that her "activity" led to the

death of many snakebite victims. The best outcome of her "doctoring" was that many agricultural workers of the Armenian Republic are now invalids.

Rumors about this "healer" were spread by certain naive, easily duped people. They extolled her "healing" because Dzhavair "healed" not by deceit or incantation, as quacks do, but with her own spit."

In 1935 a special building, a "hospital," was constructed for this quack and this supposedly proved her authority and full competence in treating snake bite victims. A check showed that she even had an official certificate which stated that "she actually can heal people and animals who have been bitten by poisonous snakes."

What was the "secret" of her treatment?

Dzhavair treated snakebite victims by spitting on the area of the bite and applying leaves of a certain plant there. She repeated this procedure 2 or 3 times a day, and if the victim lived in a remote village, then she conducted "treatment by correspondence," by spitting on a piece of beeswax and recommending that it be rubbed on the area of the bite. She believed that if she spit on a hat, the person who wore it would be protected from snakebite.

Beginning in 1933 - 1935 snakebite victims turned to this quack. It is easy to find many invalids caused by her "methods of treatment." Cases of fatal outcome after her "spitting - treatment" were very frequent.

Finally in 1939 after a fundamental experimental study of her "antivenom spit" and even her blood serum, coworkers of the Tropical Institute of the Armenian Republic, Kh. N. Pirumov and S. A. Ananyan exposed her deceit. Controlled experiments showed that "the spit of Dzhavair had absolutely no curative properties and did not contain

any antitoxins against the venom of vipers or adders. The method of her treatment was pure eye-wash and deceit." They further emphasized that "we must combat this evil more actively than we are now; it must be finally eradicated, and the sooner, the better."

More than 20 years have passed from that time. However, unfortunately, the "treatment" of snakebite victims continues in this "hospital" even now. It is interesting that even in 1942, after the death of Dzhavair, her blind son, Dadash, a man of extreme old age, was continuing her "mastery"; at this time he was teaching his daughter the "art."

By conducting explanatory conversations and exhibiting snakebite victims who have been successfully treated in our hospital, beginning from 1953 we brought it about that all snakebite victims were turning first to the Nakhichevansk hospital, and in the subsequent years to the regional hospitals of the Republic, where snakebite serum is administered.

In 1954 at the home of Dadash we saw several snakebite victims from different regions of Armenia.

At first Dadash tried to prove to us that he was an extraordinary healer, he even showed us his registration book where the snakebite victims signed in. But after we had presented him with a number of facts, Dadash confessed that he was a charlatan and promised that he would no longer accept snakebite victims. However, he broke his promise, and, accepting one more patient from the Nakhichevansk Republic, he increased the number of people he had mutilated.

This was G. Ye. A, a boy 16 years old. While harvesting he was bitten on the middle finger of his left hand. The boy was brought to Dadash. Having spent 10 days with this quack and having paid a

considerable sum for "treatment," the boy returned home. His condition worsened with each day. The flesh on the bitten finger became gangrenous and two joints fell off; then phlegmon developed on the palm of his hand. According to the advice of a field nurse the boy was sent to the surgical section of the Nakhichevansk Republic Hospital (Fig. 9). Here he was given the appropriate treatment. After a month the patient was discharged from the hospital, but he had to receive outpatient treatment for more than 5 months because the wound on the end of his finger would not heal. After the wound healed a contracture (loss of mobility) formed on the II, III, and IV fingers of his left hand.

This is only one of hundreds of the victims of quacks. But, as we found out later, this was the last victim of Dadash.

However strange it may seem, in certain regions of Armenian snakebite victims are still turning to quacks, who, of course, can render them no help and can only deceive easily duped people.

What substance is the most reliable for contemporary and successful treatment of snakebite victims?

This question has become the center of attention, especially in countries where snakebites bring great injury to the population and, have become a real calamity to the people. Finally, in 1896 the French scientist Kal'mett produced a remedy, a specific snakebite serum.

As academician Ye. N. Pavlovskiy has noted, in the first years this serum was applied, the number of fatalities from snakebite was reduced by more than one quarter. Therefore, in spite of certain difficulties connected with the production of this serum, it was widely used, especially in the first years.

What is this serum made of?

It has been established that the susceptibility of people and animals to snake venom is different and it is proportional to the weight of the individual.



Fig. 9. G. Ye. A the day he was admitted to the hospital.

To produce the serum snake venom is injected into an animal; of course, less than a lethal dose is used and in the blood serum of the animal immune bodies are formed, special corpuscles that later on can detoxicate this snake venom. This process is called immunization. All other serums, antidiphtherial, antitetanus, etc., are produced by the same method.

To produce more resistant immune bodies in the blood serum, after definite intervals of time the snake venom is repeatedly injected into the animal. In spite of the increase in the dose of venom each time, due to the presence of immune bodies in the blood serum the reaction of the organism against the newly injected dose of venom is comparatively less.

Horses are customarily used to produce snakebite serum because

a greater quantity of serum can be obtained from their blood.

The specificity of a serum means that it can basically neutralize the venom of the same species of snake. Thus, for example, the snakebite serum "antiblunt-nosed viper" neutralizes the venom of snakes from the viper family. However, there is a basis to suppose that to some degree snakebite serums can neutralize the venom of snakes of a different family or even the venom of any poisonous animal. But, in spite of this, for modern detoxication of the venom of an unknown snake, in those regions that have several families of snakes, in recent years the so-called polyvalent serums, which can neutralize the venom of several families of snakes, have been developed.

Thus, for example, the "anticobra and carpet viper" or "anticobra and blunt-nosed viper" serums have been developed.

In the Soviet Union snakebite serum was first applied by M. I. Maksianovich in 1939. In later years several other authors have reported using it. The works of A. S. Imamaliyev, concerning the successful use of snakebite serum for treating more than 80 snakebite victims, demand serious attention.

Although more than 60 years have passed since the appearance of snakebite serum, no methodology or dosage of administering the serum depending upon the severity of poisoning of the organism has been developed, neither in foreign countries, nor in the Soviet Union.

Without any basis certain foreign authors proposed "administering serum until the patient shows marked improvement." In such cases the quantity of serum sometimes attains 300 - 400 mg. Meanwhile the organism of the patient, seriously poisoned by snake venom, cannot be indifferent to the injected serum, consisting of protein and being very foreign to the body, in such a large quantity. After all, every

remedy, including a serum, must be ejected from the organism after it has had an effect.

When a snakebite victim is in serious condition, the ejection from the organism of a large quantity of serum is no doubt accompanied by great difficulty. Even if this is possible, we cannot disregard the strength and energy that a sick organism must expend on this. In this case it is well to remember the wise Azerbaïdzhan folk saying: "In trying to touch up her eyebrow, she gouged her eye out."

Actually, instead of freeing the patient from the many-sided effect of snake venom as quickly as possible, they have blindly injected an excess quantity of serum and thereby no doubt worsened the condition of the patient to some degree. Considering the importance of this question, we have been occupied with establishing a more rational dose of the injected serum depending upon the severity of poisoning of the organism.

As a result of our investigations we have established that the index of effectiveness of the injected quantity of serum and, consequently, full detoxication of the venom in the organism after a bite by an adder, together with an improvement in the general condition of the patient, is the state of the indices of the red blood (when these indices stop falling). The following doses of snakebite serum are the most rational: for light poisoning of the organism — from 20 to 40 mg, for poisoning of average severity — from 50 to 80 and for poisoning of a severe degree — from 80 — 90 to 120 mg.

After using snakebite serum we have become convinced of its great effectiveness even in extremely serious cases, previously considered hopeless.

Thus, the friends of G. G, a 13 year old girl, applied a

tourniquet after she was bitten and made incisions in the area of the bite; then they brought her to the village where a field nurse injected a solution of potassium permanganate.

With each passing hour her condition worsened. Due to the great swelling on her left leg and hip, the tourniquet was removed. She developed blisters, which were filled with a bloody liquid.



Fig. 10. G. G was brought to the hospital in this state.

The next day she was brought in very serious condition to the village hospital, where 10 mg of snakebite serum and a solution of camphor and caffeine were administered.

Having been summoned to the village, we found the patient in a very serious condition. We injected 40 mg of snakebite serum intravenously and then 30 mg subcutaneous.

After 15 - 20 minutes the condition of the patient improved a little. The girl was sent to the hospital at Nakhichevan', where her condition improved noticeably. However, the great swelling that had developed and also the wide blisters, under w. there were sections of gangrenous tissue, greatly disturbed the patient (Fig. 10).

By the evening of her first day in the hospital her condition had deteriorated. We additionally injected 30 mg of snakebite serum and took measures to increase the activity of the cardiovascular system.

In the subsequent days the condition of the patient improved with each passing hour, and on the 23rd day she was released for outpatient treatment because the wound in the region of the gangrenous tissue had not yet healed.

Snakebite serum saved the life of this girl. However, the incisions and tourniquet prolonged her stay in the hospital and under outpatient treatment (about 4 months).

This is one of many cases in which a patient got into a hopeless condition, especially after tourniquets and incisions had been applied, but was healed by snakebite serum. Many of such severely poisoned victims who did not have tourniquets, incisions or other harmful interfering obstacles applied were released on the 5th or 6th day in an excellent condition and the death rate in such cases has been brought to zero.

One of the most important questions is the treatment of wounds and also of gangrenous tissues that are covered by blisters. After the wound has been cleansed and dusted with streptocide powder, skin clips are applied to it. This procedure is usually applied to a wound that is healed by immediate union, when previously the wound had not responded to treatment for months. On a section of gangrenous tissue that is covered by a blister we apply a bandage with Vishnevskiy salve, and to a swollen limb we apply a hot-water compress. From our observations this procedure significantly accelerates the reduction of swelling.

Vitamins, especially B₁ and C, are given to the patient, and a

40% solution of glucose is administered intravenously.

Until the patient recovers completely we recommend giving as much liquid as possible (preferably tea or coffee). In this manner, as it were, we guarantee the best washing of the snake venom out of the tissues of the organism. Furthermore, to prevent the development of swelling caused by destruction of the inner membrane of blood vessels, it is expedient to inject substances that can block the permeability of the vessels. The most effective substance for this purpose is vitamin P (citrin), which tea contains in sufficient quantity. Therefore taking tea is both necessary and important. Of course, this treatment must be under the care of a doctor and according to his prescription. Self-treatment is as dangerous as the "treatment" of a quack.

Our observations, in the course of almost 10 years, of 187 snakebite victims who were treated by this method did not reveal any after-effects connected with the bites both when nonspecific substances or insufficient doses of the snakebite serum were used; there was only a different character of complications.

All this is a basis to recommend the universal application of the proposed method of treating snakebite victims. This can ensure the quick and successful restoration of health for each victim and death can be avoided.

The Prevention of Snakebite

Under the heading, prevention of snakebite, we mean protective measures. Thus, when going out, especially at night, into the forests, mountains, or the steppe, where there are snakes, one must wear rubber or leather boots. The fangs of snakes are very fragile and cannot penetrate through thick leather or rubber. They will slide off and

frequently they will break.

Among other, but less reliable protective measures, we can recommend wearing woolen socks, which the peasants usually wear during the summer in different localities.

As was already said above, snakes from the viper family are not aggressive. Most often a bite occurs because a man accidentally hurts the snake. Therefore it is necessary to observe care while working, especially in areas where there is thick grass or bushes, and in other suspicious places, which are frequently well-known to the local inhabitants. One must be particularly careful at night, when snakes and all other poisonous animals are most active.

All these safety measures are easily followed, but even they are not sufficient to reduce the cases of snake bite to a minimum.

In nature there are many enemies of poisonous snakes, for example, certain birds such secretary-birds, eagles, falcons, herons, condors, auks, chinese owls and others, some mammals and even domesticated animals (swine, goats, cattle and others). Poisonous snakes are devoured by the nonpoisonous mussurana. Furthermore, cobras eat blunt-nosed vipers, and the blunt-nosed viper eats Radde's vipers. The Indian mongoose and also certain representatives of martins and foxes are enemies of snakes.

However, even the help of these natural enemies is insufficient in the struggle against snakes.

The universal extermination of poisonous animals in general and poisonous snakes in particular is one of the best methods of sharply decreasing the cases of bites.

The extermination of snakes in France, Brazil, India and other countries gave striking results.

Thus, for example, in the course of 9 years even in India, where snakes are considered holy, about 3 million snakes were exterminated.

As academician Ye. N. Pavlovskiy has noted, in many countries of the world they pay a bounty for the heads of snakes in order to interest the population in the rapid extermination of reptiles. To avoid bites in this work it is necessary to give an appropriate preliminary explanation to the workers.

Poisonous Arachnida

The Painful Sensations After the Sting of a Scorpion

In the whole world at the present time of 6 families of scorpions 77 genera and up to 500 species are known; in the USSR of 2 families 7 genera and 12 species are known.

In the Caucasian Mountains there are 5 species of scorpions: the yellow, the thick tailed, the kolkhas, the abkhazskiy and the mingrel'skiy; in Azerbaidzhan 3 species, all of one genus.

In external form scorpions resemble the river crayfish (Fig. 11).

The thickened body of a scorpion consists of a cephalothorax and an abdomen; the abdomen is divided into a wide preabdomen and a thin postabdomen (tail).

The cephalothorax carries a pair of small maxillae in the form of small claws, which serve to grind up food. Under the cephalothorax there are large pedipalps, which end in large claws. These serve to capture food.

The postabdomen (tail) is jointed and consists of 5 segments. The last segment has a venom sack with a sharp coiled stinger. The venom apparatus of a scorpion consists of two glands (sacks), which are easily flattened. These sacks are connected with the base of the

stinger, the hollow of which serves as the excretory canal.

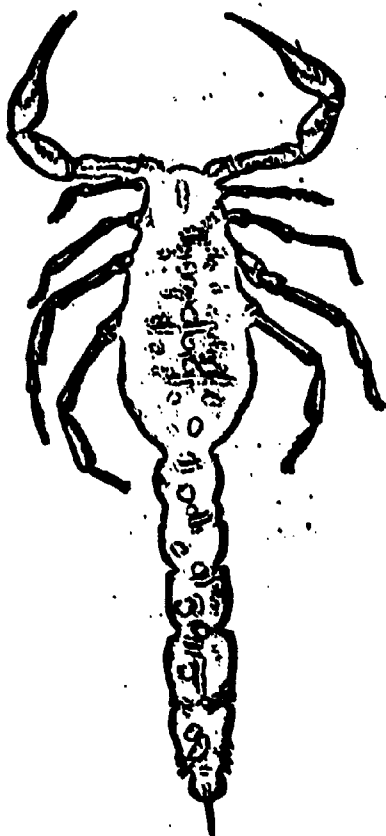


Fig. 11. Black Scorpion (life-size).

Scorpions can move very rapidly with the help of four legs on each side of the trunk. They have 5 lateral eyes on each side.

Scorpions are viviparous, but there are also some whose young are born immediately after the eggs are laid. It is interesting that frequently in the first days the "young" are attached to the back of the mother, who in this situation moves about normally.

The tail part of a scorpion is very mobile; it can, for instance,

bend upward, forward and to the sides.

Therefore a scorpion can sting from any position. When the stinger is inserted the venom flows into the wound from two small openings on the end of the stinger.

Scorpion venom is a colorless liquid that has an acid reaction. It has great resistance and toxicity. When it is dried in air it forms, as it were, a film of lacquer. It is soluble in water, but is barely soluble in ethyl alcohol.

With the onset of cold weather scorpions hibernate. They winter in deep cracks or under large rocks; some bury themselves in the ground.

As our observations have shown, in the conditions of the Nakhichevansk Republic scorpions begin to hibernate in the middle of October and continue until the end of April or the beginning of May. Consequently, in this republic scorpions are active 6 — 8 months of the year. This period is typical for many regions of Azerbaïdzhân and Armenia.

As with the majority of poisonous animals, scorpions begin to be active at dusk. At night scorpions crawl along the ground, under carpets and even into footwear. They hunt for household insects. Sometimes they even eat other scorpions, especially young ones.

It has been established that scorpions sting when they are subjected to pain. This occurs especially frequently at night, when someone accidentally steps on a scorpion in the darkness.

The degree of poisoning of the organism by scorpion venom depends upon numerous factors. Together with the quantity of venom injected, the time of the year and the genus of scorpion have basic importance.

The warmer the climate, the more serious is the poisoning of the

organism.

We will consider the conditions that arise after stings by two prevalent species of scorpions.

The first species is yellow (or red-brown); therefore people call them yellow scorpions. In the overwhelming majority of cases the sting of a yellow scorpion is harmless. At the place of the sting there is a light burning sensation; this is seldom felt in the regions of the organism above the sting. Sometimes a slight reddening of the skin and an insignificant swelling are noted. In most cases these symptoms are completely lacking. The pain continues for 15 - 20 minutes, seldom for 1 - 2 hours, and then fully disappears. Therefore the victim usually does not seek out medical attention. In separate cases there is a thickening in the form of a tubercle and also a certain decrease in skin sensitivity, which lasts for several hours.

A sting by a black or thick-bodied scorpion usually causes serious poisoning and requires immediate medical attention.

The black scorpion is found from the eastern shores of the Mediterranean to India, and in the USSR it is found Central Asia, in Crimea and in the Caucasian Mountains. In Azerbaidzhan this scorpion is found only in the Nakhichevansk Republic.

To characterize the clinical phenomena that appear after a sting by a black scorpion, we will introduce one case.

While walking outdoors at night, L. N. N, who was 20 years old, placed his head against a large rock and felt a strong pain in his right temple. Lifting up his head, he noticed a black scorpion which he killed.

With every passing minute the pain increased. Returning home,

he lost consciousness and fell down. His comrades lifted him up, but he could not explain what had happened. His condition worsened, his body became cold, a cold sweat appeared on his face, and the muscles of his face and chest began to twitch strongly. Right after this spasms started in his fingers. He was then given medical attention. About 10 - 15 minutes after intramuscular injection of 10 ml of antivenom serum and subcutaneous injection of camphor with a solution of caffeine his condition improved somewhat. Then he was sent to the Nakhichevansk hospital, where again he lost consciousness.

After a subcutaneous injection of 40 ml of snakebite serum (anti-blunt-nosed viper and cobra), and also a subcutaneous injection of a solution of adrenalin and caffeine, his condition began to improve gradually; his body became warm, he gained consciousness. However, the spasms in the muscles of his chest, shoulder and face continued. The spasms in his fingers weakened noticeably. The patient could not answer any questions put to him.

Then, after 35 - 40 minutes, the muscle spasms, especially around the mouth and in the chest, weakened. The patient could speak, but with difficulty; his speech was distorted.

An hour later, while he was eating, his general condition suddenly worsened. The spasms of the facial muscles, particularly around the mouth, increased; this was accompanied by a loss of consciousness. After an intravenous injection of 30 ml of a 40% solution of glucose and ascorbic acid, and also 10 ml of snakebite serum and a subcutaneous injection of 40 ml of a 5% solution of glucose, the condition of the patient again improved. The spasms in his fingers stopped completely. The muscular spasms, particularly in the chest, continued for more than 17 hours from the time of the sting.

In the subsequent days the treatment consisted of giving the patient a huge quantity of liquids, and also the intravenous injection of a solution of glucose and ascorbic acid; he was also given vitamin B₁ and vitamin C

On the 6th day he was released in excellent condition.

As is evident from this example, severe poisoning develops after the sting of a black scorpion; the central nervous system is particularly affected.

As our observations show, in order to save the life of a victim, prompt and correct measures must be taken.

The condition of L. N. I was more serious because he was stung in the head. The complex composition of scorpion venom, basically containing neurotoxin, which affects the central nervous system, can produce serious poisoning of the organism.

The sting of a black scorpion produces intolerable burning pains. These pains increase rapidly and are also felt in the sections of the body above the sting. In certain cases these pains produce unconsciousness. Approximately 15 - 45 minutes after the sting colic-like pains begin first in the tongue and then in the gums. In some cases there is stuttering, sometimes there is a full loss of speech, swallowing is hampered, and a swelling and reddening of the skin in the area of the sting is also observed.

These symptoms are soon accompanied by cramps in the fingers, and by spasms of the facial and pectoral muscles. Then the extremities become cold, and then the whole body. The forehead becomes covered with a cold sweat. Labored breathing, rapid heart beat and an uneasy state are also observed.

This acutely painful state can last for hours and it can end in death.

We feel it is necessary to briefly mention one folk remedy that is frequently applied after a scorpion sting. Dead black scorpions are kept in an alcohol solution for a definite period of time and this solution is applied to the place of the sting.

This absolutely unfounded method of "treatment" can lead only to an unfortunate outcome. There is nothing to counteract this scorpion venom as it is acting on the organism. This can lead to death. Even if this "antivenom" could detoxicate the venom of a black scorpion, then, unfortunately, when it is applied to the place of the sting it cannot even penetrate under the skin and therefore it can have no detoxicating effect.

To protect oneself from the sting of scorpions, and also of other poisonous animals, one must observe care, especially at night. One should not walk barefoot, particularly at night. Many poisonous insects and animals usually inhabit ruins. Therefore, particular care must be exercised close to ruined buildings. In the morning, while dressing, one must thoroughly examine footwear and clothing, since scorpions can crawl into them at night.

Clinical Phenomena After the Bite of a Karakurt

The fauna of the USSR contains 1068 species of spiders from 29 families.

All spiders are predators, but not all of them have venom glands. Venomous spiders are a great danger, because as a result of their bite an organism can be seriously poisoned. The karakurt (Fig. 12) is one of the most poisonous spiders. It bites with maxillae, which are usually connected through channels to two tubular venom glands. These glands are connected with excretory ducts, which are located on the ends of the maxillae and open through small holes close to the

sharp ends of claws.

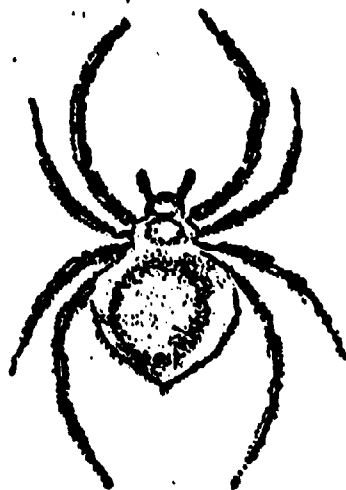


Fig. 12. Karakurt (Black wolf).

There are two species of karakurts in the Soviet Union. They are both encountered in Central Asia, Crimean, the Caucasian mountains, the Ukraine, Moldavia and in the lower Volga Basin. They are very similar in external form, but differ in the degree of poisoning they can cause.

Karakurt venom is a light oily liquid with an acid or alkaline reaction. It dissolves well in water and isotonic solutions. When it evaporates in air, it forms crystals and in the dry form it retains its toxicity for a long time. The females are poisonous, but the bite of males is not dangerous, since they lack venom glands. The karakurt reproduces by laying eggs in a cocoon at the end of the summer. These cocoons are round, slightly yellowish-white, and 1 - 1.5 cm in size. Each cocoon contains from 100 to 700 eggs. In the course of a summer from 3 to 14 cocoons are deposited. Small spiders develop from the eggs and they pass the winter inside the cocoon. In April or May the small spiders break the membrane of the cocoon, come out of it and

group close together on a web. Then the wind scatters the small spiders on their filaments and they begin independent life. The small spiders develop and by the end of the summer they are adults. However, they gradually die with the onset of cold weather and their numerous progeny survive the winter in cocoons. Consequently, only one generation develops a year. Another characteristic property is that in May and June, after mating, the female eats the male. Therefore people call them "black widow spiders" (karakurt).

The female karakurt is 3 - 4 times larger than the male. There is a bright red spot on her stomach and one or two reddish or orange bands on the lower side. The males have mottled legs and there is a bright white spot with bright red dots in the center on their stomach.

The karakurt, which spins a small web, usually lives in semi-arid, arid or mountainous country under bushes or large stones; it can sometimes be found near human dwellings.

Depending upon several natural conditions the venom of one or another species of karakurt has different degrees of poisoning. Thus, for example, the caucasian form of the karakurt, just as that found around the Mediterranean, is less poisonous than the form found in the Central Asian Republics.

Like all other poisonous animals, the karakurt never attacks man without cause. The bite is caused by an accidental touching of the spider, especially at night.

The poisoning of an organism by karakurt venom has a certain similarity to that which develops after a sting by a black scorpion.

The bite of a karakurt produces serious poisoning of the organism, frequently ending in death.

In Turkmenia there have been cases where even such huge animals

as camels or horses have died from the bite of a karakurt.

The bite is usually followed by a sense of uneasiness, nausea, vomiting, spasms in the fingers, accelerated heart beat and labored breathing. The victim becomes delirious, his body is covered by a cold sweat, his eyes run, etc.

This serious condition will sometime be rather short. If the appropriate treatment is not rendered promptly, this condition can end in death.

Is the Bite of a Tarantula Dangerous?

As strange as it seems, there is no doubt that from ancient times this statement was universally accepted: the bite of a tarantula is fatal. In the Eastern Republics there is a proverb that states: death must occur immediately after the bite of a tarantula. This same tarantula, waiting for its victim on the road to the cemetery, as though in a funeral, bites someone else.

All these are absolutely unfounded superstitions about the mild and careful tarantula, who is even afraid of people, just legends and fairy tales. The tarantula has no venom glands and its bite is absolutely harmless.

These frightening stories are evidently caused by the extremely unattractive appearance of the tarantula, one that causes squeamishness. The tarantula has a dirty covering, its body is covered with hair and it looks a great deal like a huge spider. It is possible that these fears are caused by its unpleasant habit of crawling into a house, getting into beds, etc. It is also drawn to the light of a lamp or a fire.

In the whole world there are about 500 species of tarantulas, and in the USSR there are 9 genera with 47 species.

The body of the tarantula is divided into a cephalothorax and a segmented abdomen. The body, and especially the legs, are covered by long hairs. The color of a tarantula is egg-yellow with different shades. It has four pairs of legs. The mandibles are similar to legs and can aid in moving.

Our most widespread tarantula attains a length of 6 cm. The hind legs of a tarantula are long and somewhat extended; therefore the tarantula seems significantly larger (Fig. 13).

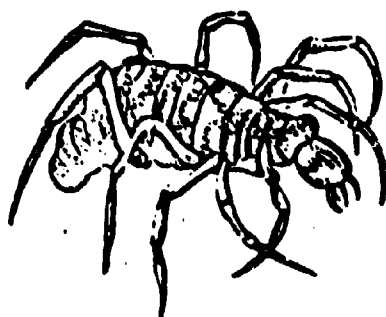


Fig. 13. Tarantula.

It seldom, but can, occur that at the moment of biting, when the tarantula's jaws are strongly squeezing the skin, a man can feel a great pain. If the skin is broken, the tarantula can put pathogenic microbes into the wound. Therefore, after a bite it is necessary to thoroughly clean the wound with alcohol or tincture of iodine. In their absence the wound should be washed with running water.

Hymenoptera

Clinical Phenomenon After a Sting by Wasps or Bees

Hymenoptera are divided into three suborders. One of these is the so-called ruminating hymenoptera, bees (wild and raised) and

wasps-hornets, among which there are also numerous varieties (Fig. 14).

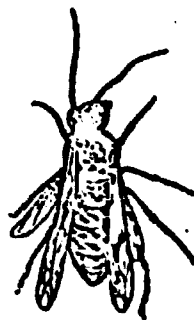
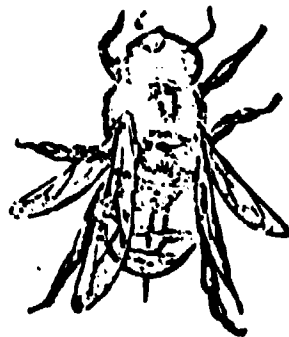


Fig. 14. From top to bottom:
honeybee, wasp, bee.

Wild bees and wasps construct their nests in the hollow of trees, frequently close to human dwellings, in the walls of houses, etc. They are active from the beginning of spring until October or November. When winter approaches they hibernate. Bees never sting without cause. As with all other poisonous animals (or insects), the poisonous

apparatus serves only for protection or hunting. In the majority of cases bees and wasps sting when their nests are disturbed.

The venom of hymenoptera is developed in two long venom glands that have a tubular form. On the last segment of the abdomen, together with the venom sacs there is a sheath of hard horn-like substance. The stinger, located in this sheath, can move independently. The stinger consists of two needles of a smooth horn-like substance and they have a chestnut color. Between the needles and on each of them there are canals along which the venom flows into the stung object. The venom of bees is very stable and toxic, it is a transparent colorless liquid and it rapidly solidifies in air, forming crystals. The venom of wasps is more toxic and has high bactericidal properties, killing all bacteria even at a 1:50,000 dilution. The composition of this venom is very complex.

A wasp sting produces an immediate burning pain that spreads to the upper sections of the body. Immediately after this, together with slight reddening of the skin there is a growing swelling and a gradually increasing itching. In separate cases small sections of hemorrhage are noted on the skin.

We have observed cases when a wasp sting on the hand has produced a swelling up to the chest and after two hours the lips, and then the cheeks and face began to swell. There was also a swelling of the mucus membrane of the mouth and even of the throat, which made breathing, and even swallowing difficult.

People who have been bitten by wasps exhibit a whitening of the skin, a gradual lowering of the temperature of the extremities, and then of the trunk. An acceleration of heart beat and breathing has also been noticed. The pulse sometimes attains 130 - 140 beats per

minute. In severe cases the patient can become delirious.

Sometimes a person can be stung by several wasps together. Then the above stated clinical phenomenon develop rapidly and can bring about the death of the victim. However, upon appropriate and prompt treatment the condition of the patient will soon improve, but the swelling that develops on the face, lips and especially on the eyelids will sometimes remain for 3 - 4 days.

We have also observed a decrease in skin sensitivity in the area of the sting; sometimes this sensitivity is not restored for 4 - 7 days.

Let us now consider the clinical phenomenon that develop after a sting by a bee.

In contrast to wild bees, honey bees perform a great service in agriculture. They give a valuable product, honey, and they pollinate plants, thus increasing their harvest. Beeswax has great industrial importance, and the products of the vital activity of bees, such as beebread, bee glue and royal jelly, have remedial properties. It is sufficient to note that about 20 different amino acids, many vitamins of the B group, in particular vitamin B₁₂, have been found in the composition of royal jelly.

In contrast to wild bees and wasps, the stinger of honey bees remains at the place of the sting together with the venom apparatus. After a certain time the bee dies.

The clinical phenomenon that develop in this are basically characterized by a brief burning pain and slight reddening. On the background of general uneasiness, labored breathing and accelerated heart beat are noted. Gradually weakening, these phenomenon disappear in the course of 1 - 3 hours.

Based on our observations of people who have been stung by wasps and bees, we have established that certain clinical phenomenon that develop after a sting, particularly those of a local character such as swelling of the face, lips and eyelids, depend upon the individual hypersensitivity of the organism. Thus, for example, the literature reports that while in one case the stings of 4 - 8 bees did not produce sharply expressed clinical phenomenon, while in another case the stings of even 2 or 3 bees produced a serious condition that required immediate medical attention.

Upon repeated and frequent, single stings by bees, the clinical phenomenon decrease each time. The organism develops an immunity against the venom of bees. Therefore, beekeepers, who are frequently stung even by swarms of bees, do not experience any painful phenomenon. However, the immunity developed against bee venom is temporary. It evidently does not last more than 4 - 6 months.

In some cases ignorance of this characteristic has led to serious consequences.

One beekeeper became accustomed to the stings and was not afraid even if a group of bees attacked him. After a long interruption he decided to return to his former occupation. As was his habit, he fearlessly walked among the beehives and once was bitten by a multitude of bees. His condition immediately became serious and he was sent to a medical station, where, in spite of the first aid he received, he died.

As is known, even in ancient times in Egypt, China and Greece various diseases were treated with bee stings. The abatement or full easing of certain painful states was evidently the reason for this.

The application of bee stings in medical practice to treat different diseases found its beginning at the end of the 17th century. Even in 1818, P. F. Gaydar reported about the successful application of apiotoxin (bee venom) in the treatment of rheumatism, diseases of the peripheral nervous system, endarteritis obliterans, etc.

This method has become widely applied, especially in the last decades; it has achieved results with a favorable outcome.

We will not consider this in more detail because treatment by bee venom is not the theme of this brochure. But we do want to note that treatment of one or another disease either by the application of various preparations prepared from bee venom, or by the direct sting of bees must be conducted only under the direct control of a physician, because with certain diseases or conditions such a treatment can lead to a sad outcome.

The Treatment of Stings by Scorpions, karakurts, wasps and bees

To successfully treat karakurt bites we apply a specific karakurt serum. It is injected subcutaneously in the interscapular region (or intravenously for serious cases) in a dose of 30 - 70 ml depending upon the severity of poisoning of the organism. A sufficient dose of this serum insures full recovery.

As academician Ye. N. Pavlovskiy noted, in 1914 at the Pasteur Institute in Paris and in Algeria A. Serzhan developed a serum against scorpion venom; this serum has been successfully applied for treating people who have been stung by scorpions.

The clinical phenomenon that develop after a sting by a scorpion, wasp, or bee or after the bite of a karakurt have much in common.

This indicates that the venom from these creatures is similar in composition. Among these phenomenon disturbance of the nervous system predominates, which indicates the predominance of the neuro-tropic substance in the venom. Considering the absence in our country of a specific remedial serum against the venom of the black scorpion, a bee or a wasp, and also a certain generality of the venom of snakes and these animals (insects), we have managed to develop a successful method of treating people who have been bitten (stung) by these poisonous animals. The application of anticobra serum has turned out to be effective.

Our observations have shown that the most effective substance for treating people who have been stung by a black scorpion, a bee or a wasp is the anti-karakurt serum. It is subcutaneously injected in doses of 20 - 60 ml depending upon the severity of poisoning, and in serious cases, it is slowly injected intravenously.

Among the remedies we must also consider those substances that regulate the activity of the cardiovascular system (caffiene, camphor, cordiamin, etc.). As in snakebite, such first aid measures as the application of tourniquets, incisions, burns, etc., are absolutely pointless and harmful.

First aid should consist only of giving a large quantity of liquid and then the patient should be brought immediately to a hospital.

As we have already shown, the preventive measures are basically the observance of carefulness, particularly at night in those places where poisonous animals and insects are frequently encountered.

For the final prevention of karakurt bites and stings of the black scorpion, bees and wasps, we must have universal extermination of poisonous animals and insects. We must fight against the karakurt,

destroying its progeny in the cocoons during the fall, winter and early spring. Bees and wasps must be exterminated by burning their nests. And scorpions must be exterminated in any conditions, observing all preventive measures.

We have acquainted you with certain biological properties and the clinical states that develop after a bite (sting) of snakes and other poisonous animals. As is evident from the introduced data, after a bite (sting) by these animals a serious poisoning of the organism usually develops, often endangering the life of the victim. All this is connected with the complexity of the venom of these animals (insects), each of the components of which can selectively affect one or another system of the organism. Thus, for example, while the neurotoxin in the venom negatively affects the activity of the nervous system, the hemolysin destroys the red blood globules and the endotheliolysin affects the internal endotheliomembrane of the blood vessels, increasing its permeability, etc.

A characteristic and very important property of the venom of snakes and other poisonous animals is that it can spread very rapidly in an organism. Therefore, the rapidly developing serious condition of victims of bites (or stings) by poisonous animals usually requires immediate medical attention, and most important, the application of substances that possess the property of detoxicating the venom in the organism.

The various substances that have been applied until recently in medical practice, such as solutions of novocain, potassium permanganate, sodium thiosulfate, and many others, the so-called nonspecific substances, and also such first aid measures as the application of a tourniquet above the place of the bite and making incisions or

burning the area of the bite and similar measures that are firmly implanted among the population not only are not effective, but often, as we have shown, only complicate the situation.

The most effective substance for successful treatment of the bites of snakes and other poisonous animals is the specific antivenom serum. As our numerous observations have shown, because it can detoxicate the venom in the organism of the victim, it is effective even in cases that were previously considered hopeless. Together with a great shortning of the patient's stay in the hospital, the death rate can be brought to zero. Of course, all this can be attained only by the correct and judicious use of this method of treatment. This primarily means the injection of the necessary quantity of antivenom serum depending upon how severely the victim has been poisoned.

The treatment of incisions and gangrenous flesh, which is found beneath the blisters that develop in the area of the bite, is also important and necessary, because these wounds generally do not respond to treatment for a long time. The application of Mishel' skin clips to the wounds after they have been cleansed and dusted with streptocide powder usually brings about primary healing. Gangrenous flesh can be successfully treated by the application of Vishmenevskiy salve bandages with periodic washing in a solution of potassium permanganate. All this can be conducted only in a medical institution under the direction of a doctor.

When there are open wounds, gangrenous tissue or other unfavorable circumstances, antibacterial serum must be injected.

The application of a warm water compress on the swollen limb (or region) can accelerate the reduction of the swelling.

Together with the above stated measures, to accelerate the restoration of the functions of the organs, especially important organs as the liver, heart or kidneys, which have been subjected to the many-sided effect of the venom, the patient should be given vitamins (especially those of groups B and C), a glucose solution should be injected intravenously, and when necessary up to 400 - 500 ml of a 5% glucose solution should be injected subcutaneously. The patient should also be given a great deal of liquid, especially tea or coffee. The taking of liquid enables washing the venom out of the tissues, of course, only to a certain degree, and also decreasing its concentration in the blood.

The application of antivenom serum in combination with certain symptomatic substances and measures will guarantee the rapid detoxication of the venom in the organism.

The method of applying antivenom serum is simple and it can be accomplished at a field station or a first aid point. However, for correct treatment, after the initial dose of the antivenom serum has been injected the patient must be sent to a hospital for further treatment.

An antivenom serum has been developed at the Tashkent Institute of Vaccines and Sera.